REMARKS

The Examiner rejected claims 13-19 under 35 U.S.C. §103(a) as allegedly being unpatentable over Hall et al (U.S. Patent 5,184,768) in view of Sakemi et al. (U.S. Patent 5,489,750).

Applicants respectfully traverse the §103(a) rejections with the following arguments.

35 U.S.C. §103(a)

The Examiner rejected claims 13-19 under 35 U.S.C. §103(a) as allegedly being unpatentable over Hall et al (U.S. Patent 5,184,768) in view of Sakemi et al. (U.S. Patent 5,489,750).

Applicants respectfully contend that claim 13 is not unpatentable over Hall in view of Sakemi, because Hall in view of Sakemi does not teach or suggest each and every feature of claim 13.

Applicants respectfully contend that Hall in view of Sakemi does not teach or suggest the following first feature of claim 13: "a substrate for the attachment of a ball grid array electronic package thereto by means of solder balls **and** solder paste" (emphasis added). Note that claim 13 requires both solder balls **and** solder paste conjunctively (i.e., both solder balls **and** solder paste must be present).

The Examiner argues that reference numeral 28 in FIGS. 2A and 2B of Hall represent solder balls and solder paste together. Applicants respectfully disagree, because Hall identifies reference numeral 28 specifically as representing a solder ball (see Hall, col. 4, lines 11-13), and Hall nowhere teaches or suggests that reference 28 can represent a solder ball and solder paste or even solder paste alone. In fact, Hall discloses an embodiment in FIGS. 4A and 4B in which solder paste 48 is present but no solder ball is present. Indeed, Hall classifies the embodiment of FIGS. 4A and 4B as "an **alternative emodiment** of the invention employing **solder paste** on the substrate" (emphasis added) (see Hall, col. 4, lines 46-49. For further clarification, see Hall, col. 3, lines 56-59 in which Hall makes it clear that solder balls and solder paste are alternatives; i.e.,

"Solder material can be solder paste (as in the case of solder material applied to the substrate) **or** solder spheres (as in the case of solder material applied to the components)" (emphasis added).

In summary, Applicants respectfully contend that Hall does not teach or suggest said first feature of claim 13 as alleged by the Examiner. Accordingly, Applicants respectfully contend that the Examiner has not established a *prima facie* case of obviousness in relation to claim 13.

Applicants respectfully contend that Hall in view of Sakemi does not teach or suggest the following second feature of claim 13: "wherein **the contact arranged on the substrate is substantially quadrilateral in shape** ..., wherein said substrate contact is configured on the substrate in relation to the solder ball such that an x-ray through said electronic package illuminates said solder ball and said contact, so that a bad joint shows in an x-ray image resulting from said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said x-ray image as a quadrilateral image" (emphasis added).

The Examine admits: "Hall et al. fail to explicitly show a substrate contact arranged on the substrate by means of a second joining medium and wherein the contact arranged on the substrate is substantially quadrilateral in shape and has at least one transverse dimension greater than a diameter of said solder ball; in which said substrate contact is adapted for X-ray inspection by directing X-Rays through said electronic package to illuminate said solder ball and said contact, so that a bad joint shows in said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said X-rays as a quadrilateral image."

The Examiner argues: "Sakemi et al. is cited for showing an electronic part with bumps on a circuit board. Specifically, Sakemi et al. (figures 7a to 16) specifically figures 7a and 7c discloses and a substrate contact **6** arranged on the substrate **20** by means of a second joining medium 4 and wherein the contact arranged on the substrate is substantially quadrilateral in shape and has at least one transverse dimension greater than a diameter of said solder ball; in which said substrate contact is adapted for X-ray inspection by directing X-Rays through said electronic package to illuminate said solder ball and said contact, so that a bad joint shows in said x-rays as a round image of said solder ball and a good joint, in which said solder ball flows into said substantially quadrilateral shape, shows in said X-rays as a quadrilateral image **for the purpose of accurately determining the bonding quality in the appearance inspection between a substrate and device"** (emphasis added).

In response to the preceding argument by the Examiner, Applicants respectfully contend that Hall's invention, as disclosed by Hall, accurately determines the bonding quality in the appearance inspection between a substrate and device. Indeed, Hall discloses:

> "Note that the cross-sectional profile of a properly wetted solder joint 38 is significantly different from the cross-sectional profile of an improperly formed solder joint 39. The proper solder joint 38 is wet to the substrate solder pad 32, and also to the substrate solder pad extension 34. By inspecting the solder joints using x-ray equipment, the configuration of a properly wet solder joint 38 in FIG. 3B can be seen to be significantly different than the improperly formed solder joint 39. The proper solder joint 38 possesses a shape or profile containing the portion extending beyond the circular solder joint perimeter. An improper solder joint 39 shows only a circular profile and does not contain the portion

extending beyond the perimeter".

See Hall, col. 4, lines 32-45. In fact, the preceding quote from Hall is the essence of Hall's invention (see Hall, col. 2, line 58 - col. 3, line 2; Abstract).

Therefore, since Hall's invention already accurately determines the bonding quality in the appearance inspection between a substrate and device, and since Hall's disclosure of a novel method of determining the bonding quality in the appearance inspection between a substrate and device is the essence of Hall's invention, Applicants respectfully contend that the Examiner's argument for modifying Hall with the teaching of Sakemi is not persuasive. Accordingly, Applicants respectfully contend that the Examiner has not established a *prima facie* case of obviousness in relation to claim 13.

In addition, Applicants contend that modifying Hall to make to have the substrate contact 22, 24 (as identified by the Examiner) substantially quadrilateral in shape would destroy Hall's invention. The portion 24 of Hall's substrate contact is a tab extending from the perimeter of the portion 22 of Hall's substrate contact (see Hall, col. 4, lines 2-4; see also the tab portion 24 in FIGS. 2A and 2B). The existence of the tab portion 24 of the substrate contact is essential to hall's invention, because the presence or absence of the tab portion 24 on an X-ray image indicates whether good solder joint or a defective solder joint exists as explained in Hall, col. 4, lines 27-45 (see especially Hall, col. 4, lines 43-45). Therefore, the tab portion 24 of the substrate contact is essential to Hall's invention. However, the existence of the pad portion 24 of the substrate contact makes it physically impossible for the substrate contact 22, 24 in Hall to have a quadralateral shape. Accordingly, modification of Hall's invention to provide the

substrate contact with a quadrilateral shape would force the tab portion 24 to be removed from the substrate contact and Hall's invention would be destroyed. Therefore, Applicants maintain that it is not obvious to modify Hall to provide the substrate contact with a quadrilateral shape. Accordingly, Applicants respectfully contend that the Examiner has not established a *prima facie* case of obviousness in relation to claim 13.

Based on the preceding arguments, Applicants respectfully maintain that claim 13 is not unpatentable over Hall in view of Sakemi, and that claim 13 is in condition for allowance. Since claims 14-19 depend from claim 13, Applicants contend that claims 14-19 are likewise in condition for allowance.

CONCLUSION

Based on the preceding arguments, Applicants respectfully believe that all pending claims and the entire application meet the acceptance criteria for allowance and therefore request favorable action. If the Examiner believes that anything further would be helpful to place the application in better condition for allowance, Applicants invites the Examiner to contact Applicants' representative at the telephone number listed below.

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